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James Almond and Richard Keenen, Texas Instruments' automation aces

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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 15, NO. 5 MARCH 6, 1989

PAGE 30 TI's James Almond (seated) and Richard Keenen: CIM savvy, Tennessee style, leads to factory automation award

COVER STORY/MANAGING RESOURCES

30 CIM savvy, Tennessee style

There is a heaven in today's world of manufacturing. It is a place where people supervise the making of a product without actually manufacturing it. That place is Texas Instruments' SMT circuit board facility in Johnson City, Tenn., which wins the ELECTRONIC BUSINESS 1989 Electronics Factory Automation Award. With no help from CIM gurus, TI's automated facility is an object lesson in how to implement state-of-the-art manufacturing.

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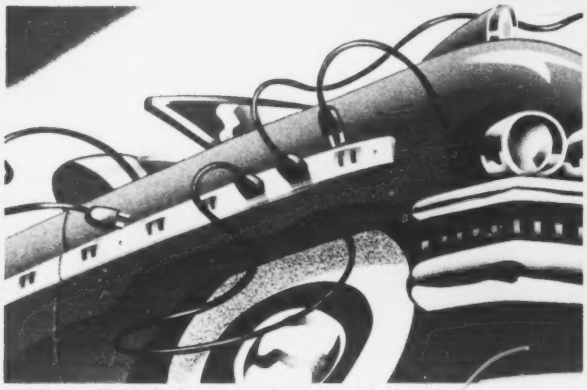

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TI sets the pace for factory automation

For years, manufacturers have been dreaming about the factory of the future — a paperless facility where interactive computers control and monitor everything from design to purchasing to billing to inventory control to production. While the truly paperless factory largely remains a dream, much progress has, in fact, been made on computer-integrated manufacturing.

To reward CIM pioneers, ELECTRONIC BUSINESS and its sister publication, *Electronic Packaging & Production*, each year grant their "Electronics Factory Automation Award" to the U.S.-owned plant they believe provides the most outstanding example of automation in action in the electronics industry. The 1989 winner is Texas Instruments Inc.'s circuit-board facility in Johnson City, Tenn.

Since it came on stream in 1987, TI's custom manufacturing SMT line has produced 250,000 boards of more than 30 types. Complexity of products produced on the flexible electronic manufacturing assembly cell has ranged from automotive window controllers to boards for high-resolution graphic workstations with component densities running from 20 components to over 500. The facility is expected to increase output by 70% this year. Moreover, it has returned more than double the modeled after-tax ROI in the more than 18 months is has been in operation. Assistant editor Tony Greene went to Johnson City for a first-hand look at TI's success story, and his observations are in this issue's cover story.

When most major computer companies were jumping into the telecommunications equipment market, Digital Equipment Corp. countered the trend. When competitors were entering the market for private branch exchanges, for example, DEC executives made a decision that would direct DEC's future strategy: DEC — then, now and always — would not manufacture telecom equipment. Instead, DEC opted to customize products if necessary, find experienced partners, and always, always adhere to standards.

Anne Knowles, senior editor

This strategy has paid off. While others have demonstrated that computers and telecom don't mix, DEC has — by staying out of telecom equipment manufacturing — built one of its largest industry marketing groups and gained the confidence of telecom suppliers and customers. And it has avoided the expensive mistakes others have made. EB senior editor Anne Knowles reports on this successful strategy.

BETH KARLIN, managing editor

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Digital audio tape storage systems hit the market

GigaTrend leads the way, with at least 15 others slated to introduce products this year. But will they be competitive?

Digital audio tape storage systems have arrived. In the next few months, users who want to take advantage of the high-capacity storage capabilities of this technology will have a number of sources and design formats to choose from. But if it's standards you want, DAT's going to take some time.

With more than 15 manufacturers eyeballing the data DAT market, views differ on how to best implement design formats. During 1988, potential data DAT manufacturers organized themselves into two well-established camps, both aiming at defining a single standardized format.

Although both sides have differing views on format design using a 5.25-inch form factor, they agree that data DAT is an ideal technology for reliable computer storage offering users up to 1.3 gigabytes of memory. And because data DAT uses the same transport mechanism as consumer DAT drives, it is in a prime position to profit on economies of scale if — and when — the consumer market takes off in this country.

But for the time being, data DAT will have to go it on its own in the United States because litigation threats from the recording industry are effectively keeping the consumer DAT market closed. And until consumer digital audio products are produced in volume, thus reducing the component costs, data DAT may have a difficult time competing with the popular, low-cost 0.25-inch and 0.5-inch tape drives now being used in the workstation and small minicomputer markets.

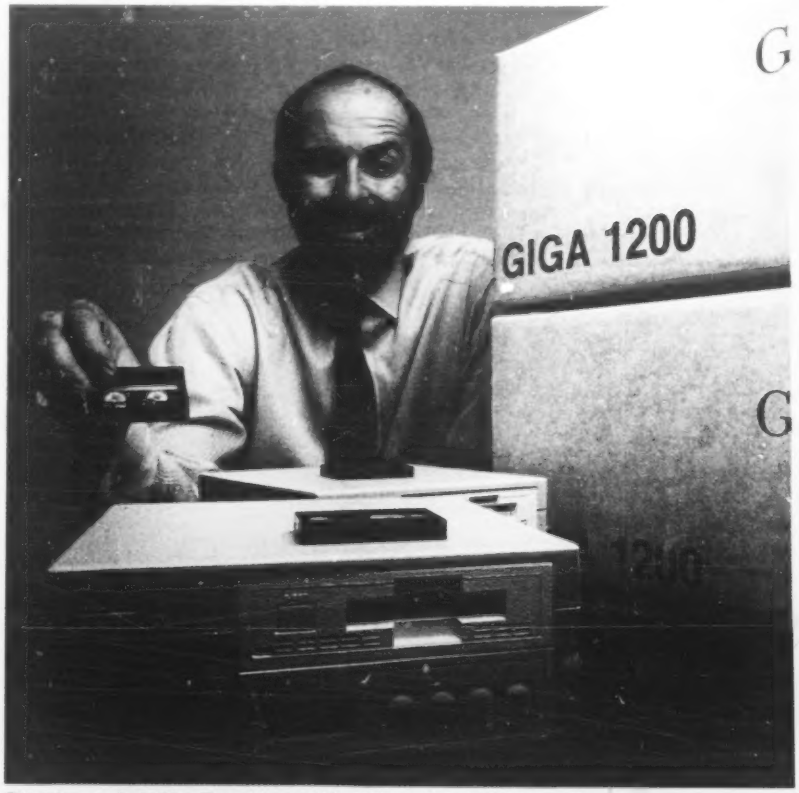
Although the DAT storage market is still untested, the large number of potential manufacturers and end users attending format group meetings indicates stakes are high. The worldwide market is projected to grow from 21,000 units in 1989 to 585,000 in 1993. Total market revenue is expected to increase from $30.4 million to $351 million during the same period, according to Freeman Associates Inc., a Santa Barbara, California-based market research firm. Freeman researchers estimate that by 1993, the data DAT market will secure a 16% unit market share of the entire computer tape storage market, estimated at 3.6 million computer tape drives for 1993.

While industry analysts are unclear regarding which format will be accepted by the American National Standards Institute, they do not rule out the possibility of a split decision, that is, the possibility of more than one standard being accepted. But, they add that it could take until 1990 or 1991 before the issue is resolved.

In one corner, being managed by a Hewlett-Packard Co. and Sony Corp. joint effort, is the Digital Data Storage (DDS) format group, currently with 10 licensed member companies. On the other side of the ring is the Data-DAT (DD) group, being supported by such heavyweights as Apple Computer Inc., Hitachi Corp. and Toshiba America Inc.

Differences in the two designs essentially boil down to two features: the DD group offers a changeable random-access mode and higher data integrity. DDS group spokesman Bert Vermeulen, product marketing director for the Bristol, England, division of HP, counters that those features are overkill and that "it is more complex to build a format that way, causing capacity and transfer rates to go down dramatically." But the DD format can also be driven in a streaming mode similar to that of the DDS format, with a competitive transfer rate.

While DDS proponents view market applications as "primarily backup," the DD group also sees a need for imaging applications that



Robert Burroughs

First to market, GigaTrend is confident that data DAT demand will be strong, says marketing chief Lee Elizer

can be retrieved and altered. Memory-intensive medical brain scans stored on the DD format can be accessed by a patient's name and changed, for instance. Thus, a key difference will be the added costs observers predict the DD format will demand to support its higher integrity and read-write mode — a cost, observers say, that will vary from manufacturer to manufacturer.

Market strategies

Market timing is important to many suppliers and some feel the standards process hampers their ability to get a product out fast. "The DDS format is more developed," says Louis Domshy, director for marketing for WangDAT Inc. in Costa Mesa, Calif. "It's the easiest vehicle to get into the marketplace quicker."

While the issue of standardization is being wrestled with, one start-up company has developed its own data DAT offering. GigaTrend Inc., a Carlsbad, Calif., active DD supporter, recently launched its own format drive, priced at over $2,500 for OEM level quantities and $4,200 for single sales. "We have gone to market with our product with the full realization that when the standard is developed we will offer that particular format as an extra format on our drives," says Lee Elizer, executive vice president for marketing and sales at GigaTrend. While Elizer cannot estimate the cost of adding an additional format, he believes it to be inexpensive.

"DAT will be expensive coming in and will have difficulties competing early on," says Richard Young, Hitachi's director for marketing in Torrance, Calif. Several manufacturers estimate the hardware to cost in the range of $1,500 to $2,000, but expect that will come down, especially if the consumer market moves forward.

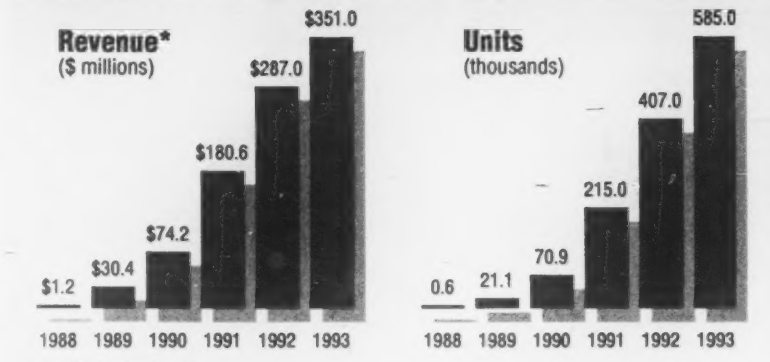
Besides targeting the workstation and small minicomputer markets, companies such as HP will concentrate on local area networks. HP's Vermeulen views the LAN market as a gateway to the vast PC market. And companies such as Alps Electric (USA) Inc., which make DAT mechanisms for both the consumer and data storage markets, are biding their time waiting for both markets to take off. Alps even has a 3.5-inch mechanism which data DAT manufacturers say they won't implement until next year, assuming the 5.25-inch market catches on.

Even though many data DAT manufacturers will use consumer media priced at about $10, media-maker Carlisle Memory Products Inc. reports it has developed an upgraded media for computer storage which it estimates will cost about $20 per cartridge.

Meanwhile, most in the industry believe a single standard is best for both manufacturers and users alike, but not all agree such a feat can be accomplished. Says Dataquest Inc. analyst Louise Biggs: "I don't think that any one format will become standard. Some will have a stronger market share, but there are too many players, too many opinions and too much at stake."

JOHN MCCREADIE

Worldwide data DAT tape drive market



* At OEM price levels

Source: Freeman Associates Inc.

Strong consumer demand will bring data DAT prices down

You can't do DAT, or at least that's the song being sung by the recording industry

Threatening lawsuits, record companies have been successful in stifling DAT system sales to the U.S. consumer market, despite their success in Japan and West Germany. Because the recording quality of DAT is nearly perfect, fears of copyright infringement and loss of record and compact disc sales have prompted the industry's strong resistance to the technology.

But without the volume potential of the consumer market, the cost of data DAT devices will be markedly higher and could have an impact on the ability of drive makers to successfully compete in other tape storage markets.

Views, however, differ regarding the degree of that impact.

"Because the consumer mechanics is only 30% to 35% of the storage drive, if they don't meet their consumer targets, it's going to be 'so what,' " says Lee Elizer, marketing executive VP at Carlsbad, California-based GigaTrend Inc.

Quarter-inch tape drive maker Archive Corp., a Costa Mesa, Calif., licensed DDS player, says the consumer market will "significantly impact the price of these drives." Says Archive's director for marketing Rich Peters: "The longer it takes the consumer side to get to full volume, the harder it will be on [data DAT manufacturers]."

Hitachi Corp.'s director for marketing, Richard Young, says that company will carry over as much as possible from the consumer side. He estimates that figure to be as high as 50%. So, he remains positive: "DAT on the consumer side is going to be here some day." □

DEC: The unlikely hero in telecom

When other computer makers were rushing into telecommunications, DEC held back. And it's not sorry

BY ANNE KNOWLES

Digital Equipment Corp. long ago made the decision to stay out of the market for telecommunications equipment. When the market for private branch exchanges, the telephone switches installed at customer sites, looked ripe for the taking a few years back, DEC executives mulled over the possibilities and made a decision that would dictate the computer maker's approach to the telecom market for years to come: DEC — then, now and always — would not manufacture telecom equipment.

Instead, telecom became one of DEC's 10 major industry marketing groups. The company decided it would continue to sell to telecom customers such as AT&T and the Baby Bells by customizing its products if necessary; partnering with experienced players when possible; and always adhering to standards, according to Dan Latham, DEC's director of global telecommunications industry marketing.

DEC made the right decision. Other companies in the industry have demonstrated that computers and telecommunications don't mix. The two technologies may be becoming increasingly hybrid, but the two businesses — sales, marketing and such — react to one another more like oil and water than bread and butter.

Computer makers are successfully selling datacommunications products, such as local area networks; and low-end voice communications products, such as modems; but high-end telecom equipment and services are another matter. IBM — which has had one communications misadventure after another — divested itself of its myriad voice communications businesses last year after selling its stake in MCI Communications Corp. and its Rolm division to West German telecom supplier Siemens AG.

By staying out of the manufacture of telecom equipment, DEC has avoided the expensive fiascoes others have endured. More importantly, by remaining on the periphery of such a competitve industry, the Maynard, Mass., computer maker has gained the confidence of telecom suppliers and customers. In the process, DEC has built one of its largest industry marketing groups, second only to manufacturing, according to analysts. Neither DEC nor market researchers will estimate the computer maker's sales to telecom customers, but Jonathan Fram, technology analyst with Bear Stearns & Co. Inc. in New York City, says DEC's sales to the telecom industry are likely over $1 billion a year.

Dave Bradley

Dan Latham, DEC's director of global telecommunications industry marketing: "We will not build major solutions without customer involvement"

DEC's dogma

"Our top level corporate objective is to be a good partner," says Bill Kania, group manager of DEC's Telecommunications Systems group. The three rules to that, says Kania, are "don't compete, don't make exclusive deals and give your partners platforms to develop applications." Another rule, says DEC's Latham, is to not develop products in a vacuum. "We will not build major solutions

without customer involvement."

"DEC is everybody's ideal partner," says Ken Hoyt, manager for telecommunications industries at Arthur D. Little Inc. in Cambridge, Mass., "because they don't do exclusive deals with anyone." The computer maker, "has a willingness to work with so many people flexibly."

That includes deals with most major telecom companies, including foreign telephone agencies, or PTTs, such as the West German Bundesposte; all of the Regional Bell Operating Companies (RBOCs); and telecom equipment suppliers such as British Telecommunications Plc, Northern Telecom Ltd. and Siemens.

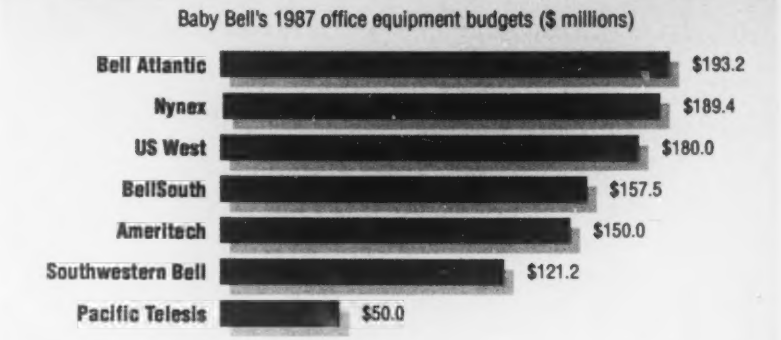
Some are traditional original equipment manufacturer arrangements, like the one with Siemens, which embeds DEC's PDP-11s in its packet switches. Most deals, though, are joint development or marketing of software solutions. "DEC is well-positioned with the best third party in the industry," says analyst Dave Power, vice president of the information technology group at the Lexington, Mass., consulting firm of Temple, Barker & Sloane Inc. "And that's Bellcore," the research company established by the RBOCs.

All current joint development work is in software, says Kania. DEC and Pacific Telesis Group, for example, have jointly developed an electronic mail package that was originally intended for internal use at the San Francisco-based PacTel, but will now be used externally as a customer service since the RBOCs were granted admission into information services.

"At the time we started looking" for a partner in 1984, says Jeanne Bracken, director of message handling at PacTel, "not a lot of vendors had a strongly expressed endorsement of standards." DEC did and PacTel signed up with the computer maker in May of 1987. DEC's early commitment to the Open Systems Interconnect, or OSI, standard, says Bracken, sealed PacTel's decision to work with DEC to develop an electronic mail package.

Joint hardware development work between DEC and a partner is rare. However, the exception is AT&T, which is one of the company's three largest customers, according to DEC. AT&T and DEC jointly develop central office applications using DEC VAXs which allows the telecom carrier to retain rights to the products.

The RBOCs: A DEC telecommunications target



Total for the RBOCs: $1,041.3 million

Source: Company reports

Due in part to its relationship with AT&T, DEC has the largest installed base of computers in the telecom industry, analysts and DEC executives agree. "Because DEC's installed base is so significant," says Power, "there is a lot of opportunity."

Knowledgeable networks

Today, that opportunity revolves around the intelligent network. Right now, most telephone networks are hard-wired. If a carrier wants to offer a new service, central office switches have to be reprogrammed. Phone companies, bombarded by competition from one another and from private networks that "bypass" public lines, want to be able to offer new services more quickly and flexibly using networks with more intelligence.

DEC has the largest installed base of computers in the telecom industry

The question remains, though, exactly where the intelligence will reside. "Which will do it?" asks Power. "Computers or communications?" Switch makers want to do it, says Power, but have not been successful with similiar projects in the past. In addition, there are so few switch makers that telecom companies are wary of placing their hopes with them. "The option is to keep switches as is," says Power, "and put intelligence in a central processing unit that has an open architecture."

"It has yet to be determined," says DEC's Kania. "Today, switches handle it, but our customers say they won't in the future." Kania says the solution may be a coupling of computers and switches. "We are in alliances with switch vendors," says Kania. "We are working with them to hook switches and computers together to distribute data."

So far, DEC has announced one joint development arrangement — with switch maker DSC Communications Corp. in Dallas — and is talking with a number of other switch vendors, says Kania. DEC also has developed, but has not yet announced, a version of the common programming language for switches, known as CHILL, for its VAXs. DEC jointly markets intelligent network applications with BellSouth International.

Another interesting opportunity for DEC, says analyst Power, is tying the network environment to a phone company's customer service department. Now, billing, service, engineering and other departments at a phone company are discrete islands of automation. Connecting them, with access to the same database, would enable phone companies to speed up and expand their service in the same way intelligent networks will.

To do that, phone company management "will want access to huge databases," says Latham. That may create the biggest opportunity of all for DEC. "That opens up a whole new market for workstations." □

Apple and Next back NuBus, but EISA is holding it back

The long-ignored 32-bit architecture looked so promising when it was adopted for the Mac II. But wilder market forces are at work

BY RICK WHITING

Riding on the coattails of Apple Computer Inc.'s Macintosh II, the market for third-party products based on the NuBus architecture is booming. But NuBus has yet to catch on outside of the Macintosh market, and its backers say that confusion created by the proposed Extended Industry Standard Architecture (EISA) is to blame.

"It is not growing as rapidly as we had hoped," concedes Gerry Laws, chairman of the NuBus Manufacturers and Users Group (NuGroup), which is promoting NuBus as a standard. "The advent of EISA has made everybody jump back and reevaluate the situation. That's really muddying the waters right now."

Developed at the Massachusetts Institute of Technology in the late 1970s, NuBus was commercialized in a limited way by peripherals vendor Western Digital Corp., and then by Texas Instruments Inc. in its artificial-intelligence workstations. But NuBus remained in relative obscurity until 1987, when Apple incorporated it into the Macintosh II.

NuBus boosters see the bus architecture as both the heir-apparent to the venerable ATbus in the PC market, and an alternative to other 32-bit architectures used in industrial and manufacturing control systems and workstations.

Backers thought the PC market would be the first to embrace NuBus because it provided a natural growth path from the 16-bit ATbus, according to Mizar Inc. chief executive Joseph Ramunni, who serves as NuGroup's promotions director. The 32-bit NuBus offers high-performance throughput and, because of its simple design and connector specifications, is easier for system vendors to implement.

But that was before EISA and IBM's Micro Channel Architecture (MCA) entered the fray. Last September, nine microcomputer companies, led by Compaq Computer Corp., endorsed development of the 32-bit EISA bus as an extension to the ATbus. The move is an effort to capitalize on doubts about IBM's use of MCA in most of its PS/2 line of personal computers.

Laws and others in the NuBus movement say the EISA proposal has caused a number of companies that were considering NuBus systems to delay committing themselves to the architecture. "It's clearly holding up the NuBus," Ramunni says.

Compaq, for example, had been designing PCs based on NuBus early last year before opting to move for the EISA standard. Although a NuBus system was technically feasible, according to systems engineering vice president Gary Stimac, it would be incompatible with the huge catalog of add-on products for AT systems and that it made more sense to extend the ATbus architecture.

At Apollo Computer Inc., personal workstations marketing manager John Davis says there is an "ongoing evaluation" of EISA and NuBus for possible use in Apollo workstations. Currently, Apollo's low-end systems offer the ATbus while high-end workstations use the VMEbus.

Davis says that the high performance of NuBus is offset by EISA's

Scott Hill

NuGroup's chairman and senior member of TI's technical staff, Gerry Laws: He had fun, fun, fun till EISA took his NuBus away

planned compatibility with the ATbus, and that a final decision will hinge on the technological superiority of NuBus versus the marketing advantages offered by EISA.

NuBus has been slow in winning acceptance among vendors of high-end systems, where the VMEbus now reigns. Last year saw few NuBus-based system unveilings, with the October debut of Next Inc.'s workstation being the major exception.

Next's hardware engineering vice president, Rich Page, says the company chose NuBus for its workstation largely because third-party product developers are familiar with the architecture. Next's NuBus differs from other implementations in that it uses CMOS technology rather than bipolar devices to interface with the backplane, and in that its 25 MHz clock rate is two-and-a-half times faster than the proposed standard.

As the bus battles rage, many vendors are sitting on the sidelines trying to pick a winner. By all accounts, the share of the board-level product market held by NuBus remains small. Databus Market Reports, Santa Clara, Calif., estimates that in 1988, NuBus accounted for just under 4% (about $50 million) of the total $1.256 billion worldwide market.

The NuBus market is, nevertheless, expected to grow rapidly despite being largely confined to the Macintosh II. Richard Bloss, a project director with the Frost & Sullivan Inc. research firm, is projecting worldwide sales of NuBus board-level products to grow from $33 million in 1987 to $220 million in 1992 — with most of that growth coming in the later years. Ramunni says the consensus is that NuBus will become "a multi-hundred million dollar market over the next three years."

Estimates of the number of vendors developing or shipping NuBus products for the Mac II range from 100 to several hundred. "I think the Macintosh by itself will carry a large part of the [NuBus] market," according to Bill Nowlin, engineering vice president at National Instruments, which markets data acquisition and instrument control cards for the Macintosh II.

The recent development of NuBus interface chips by Texas Instruments and VTC Inc., Bloomington, Minn., is also expected to boost the NuBus industry by making it easier for vendors to develop add-in products for NuBus systems.

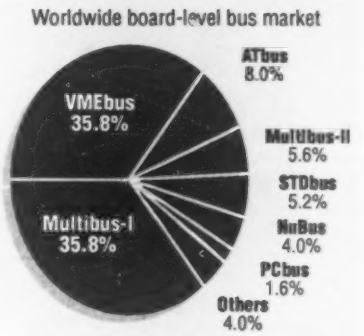
"There appears to be a lot of interest in it," says Brian Kelly, section manager for advanced bus interface at TI. "We think that our chips are going to help a lot in getting the market to grow [and] it looks like a good business for us."

NuBus backers remain steadfast in their belief that the architecture has a bright future. Most are confident that a breakthrough system using the bus — most likely a workstation being developed by a major unidentified vendor, Laws says — will make its debut this year and crack the market wide open.

"Long range, I still think it has potential," Laws says, adding that NuBus is making headway in such areas as embedded systems in military avionics and telephone switching gear. NuBus products developed for the Mac II range from processor boards to signal and image processing cards.

"I think that if some workstation vendor or PC vendor comes out with a NuBus system, that will open things up," Ramunni agrees. Mizar, Carrollton, Texas, markets a line of board-level processors using the VMEbus and STDbus and is developing a line of NuBus board-level products for debut later this year.

It's easy to miss the NuBus



Boost from Next

Next's use of NuBus could give the architecture a boost. A spokesman for Prime Computer Inc., for example, says the Next workstation "has piqued our interest [about NuBus] and we are investigating" its possible use.

Texas Instruments now markets several specialized systems incorporating NuBus: the Explorer and MicroExplorer symbolic processing workstations, (the latter a Macintosh II with a Lisp coprocessor) and the Unix-based System 1500 minisupercomputer. TI holds the NuBus trademark and several patents.

Laws, a senior member of Texas Instrument's technical staff, believes that NuBus will ultimately play a role in the PC market. He predicts that even if EISA becomes the standard for personal computers using Intel Corp. microprocessors, PCs based on other chips might move to NuBus. Nowlin, who is also NuGroup's technical director, envisions a PC market evenly split between NuBus, EISA and MCA.

Maurice Klapfish, a division manager who follows the bus market for Venture Development Corp. in Natick, Mass., gives NuBus the edge because EISA remains only specifications on paper, while developing a system using MCA means paying royalties to IBM or facing the threat of lawsuits.

NuBus might even benefit from the current EISA versus MCA debate, according to Roger Storer, president of Second Wave Inc., Austin, Texas, which markets a NuBus-based expansion chassis for the Macintosh II. "NuBus is just sort of moving along independently of all that," Storer says. "It's not exactly taking off. But it is certainly growing while this EISA-Micro Channel thing is going on."

But will NuBus give Intel's Multibus II and VMEbus a run for their money? Ramunni remains skeptical, saying that many vendors of industrial systems have already committed to the VMEbus and that there are plans to improve the performance of that architecture.

Mercury Computer Systems Inc., Lowell, Mass., markets a NuBus version of its MC3200 coprocessor board for the Macintosh II. But president Jay Bertelli notes that despite gains made by the Macintosh II in industrial and manufacturing markets, NuBus is supported by no other major systems vendor. "I don't think it's going to be as good as the VME market," he says. □

How long can this expansion last?

The current U.S. economic expansion has entered its seventh year as of December 1988. During this phenomenal growth period, the U.S. economy has grown from just over $3 trillion to almost $5 trillion. After adjusting for inflation, the economy increased by 27%, or just over 4% per year at a compound annual rate. Such a rosy performance has many wondering, how much longer can this expansion last?

Of 54 economists surveyed in the Blue Chip Economic Indicator, Sedona, Ariz., 35% believe a recession will begin in 1989. Another 30% see the downturn arriving in 1990, and 30% see it in 1991. Compare that January 1989 poll with the poll taken 11 months earlier, when 58% expected a recession in 1989.

The upshot: Economists can't agree on when the next recession will take place. Regardless of when, 80% of those polled agree on one important feature. The recession will be less severe than in 1982, when the gross national product (GNP) dropped 2.5%.

Cahners Economics' forecast calls for GNP to rise a modest 2% in 1989 and 2.7% in 1990. That 2% forecast for 1989 is down considerably from the 3.9% growth estimated for last year. The reason growth will be sluggish: No individual sector of the U.S. economy seems primed to keep pumping at 1988's strong pace.

Relatively high interest rates will probably keep a cap on consumer spending. Concern over the federal deficit will keep government spending growing just at the rate of inflation. Factory output will be cut a bit as businesses try to cut back inventories. And export levels are not expected to increase much in 1989.

Cahners does not expect a full-fledged recession either, because no part of the economy appears ready to squeeze U.S. growth too tightly. The biggest blot on the economic horizon, and most difficult to gauge, remains the high debt levels.

Impact on electronics

Business investment in equipment will carry makers of electronics products through a sluggish 1989. After growing over 13% in 1988, equipment investment will most likely grow a slower 1.8% in 1989. Still, information processing equipment continues to gain a larger share of all those business investment purchases.

ELIZABETH B. BAATZ

Blue Chip economic consensus

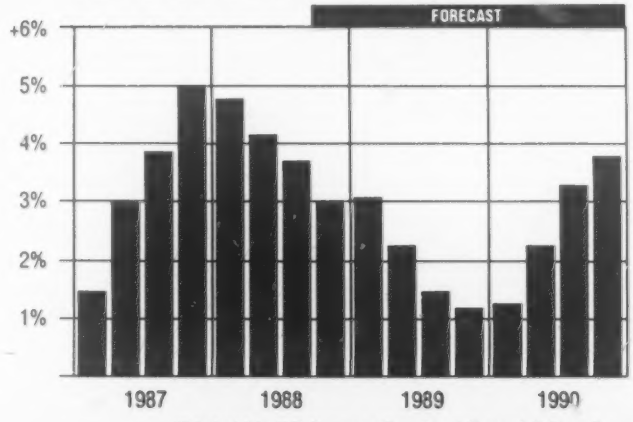
Percentage change from previous year

			FORECAST	
	1987	1988	1989	1990
Real GNP	3.4%	3.9%	2.7%	1.7%
Consumer price index	3.6%	4.3%	4.7%	4.7%
Industrial output	3.8%	5.7%	3.3%	1.7%
Disposable income	1.7%	3.3%	2.6%	1.7%
Business investment	2.8%	9.6%	4.9%	2.0%
Pretax profits	3.9%	4.9%	3.1%	1.6%

Source: Blue Chip Economic Indicators

Gross national product

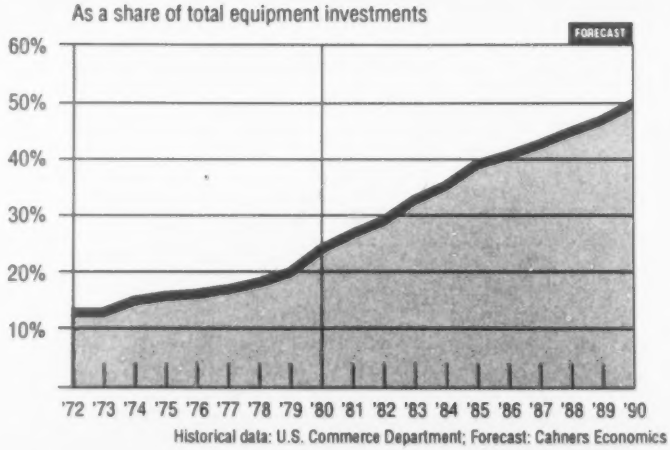
Percentage change from previous year, adjusted for inflation



Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Information processing equipment investments

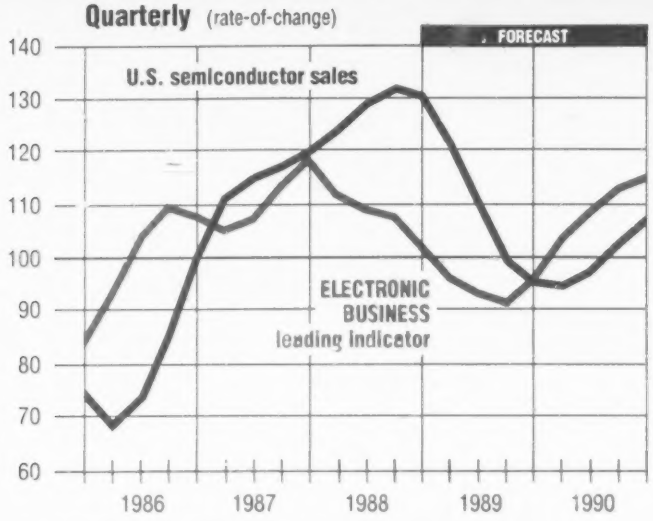
As a share of total equipment investments



Historical data: U.S. Commerce Department; Forecast: Cahners Economics

ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton, Mass., 02158, or call (617) 558-4368

Monthly (rate-of-change)

In December of 1988, the ELECTRONIC BUSINESS leading indicator fell below 100 for the first time since the beginning of 1986. The indicator is dropping at a faster rate than over the summer months, confirming that 1989 will be a weaker year.

Source: Cahners Economics

Electronics industry indicators this month

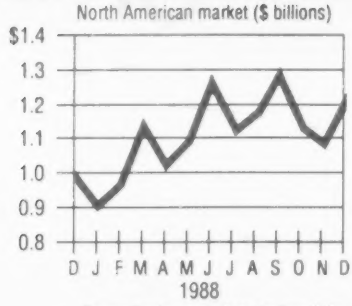
	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, Nov.)	101.9	103.4	117.6	111.1
U.S. semiconductor bookings ($ millions, 3-month average, Dec.)	$1,066	$1,071	$1,057	$951
Weekly hours of semiconductor production workers (monthly average, Nov.)	40.2	39.9	40.8	40.6
Electronic components leadtime index (1977 = 100, Jan.)	111.6	89.8	96.5	100.7
S&P's semiconductor stock price index (1970 =10, monthly average, Dec.)	45.8	44.2	55.8	65.5
Change in electronic components inventories ($ millions, SA, Nov.)	+$283	+$101	+$95	+$41
Contract and orders for plant and equipment ($ billions, SA, Nov.)	$39.6	$38.4	$35.4	$34.6

SA = seasonally adjusted, all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

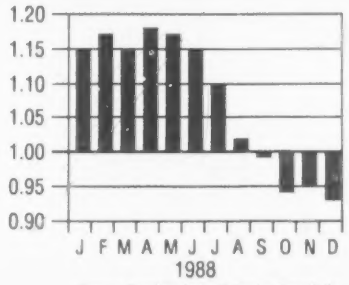
Semiconductor sales

North American market ($ billions)



Source: Semiconductor Industry Association

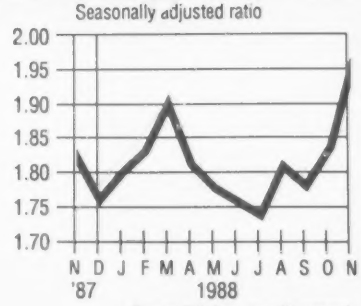
Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio



Source: U.S. Commerce Department

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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

MARCH 20, 1989

THE CHANGING FACE OF PURCHASING

Paper processors become strategic managers

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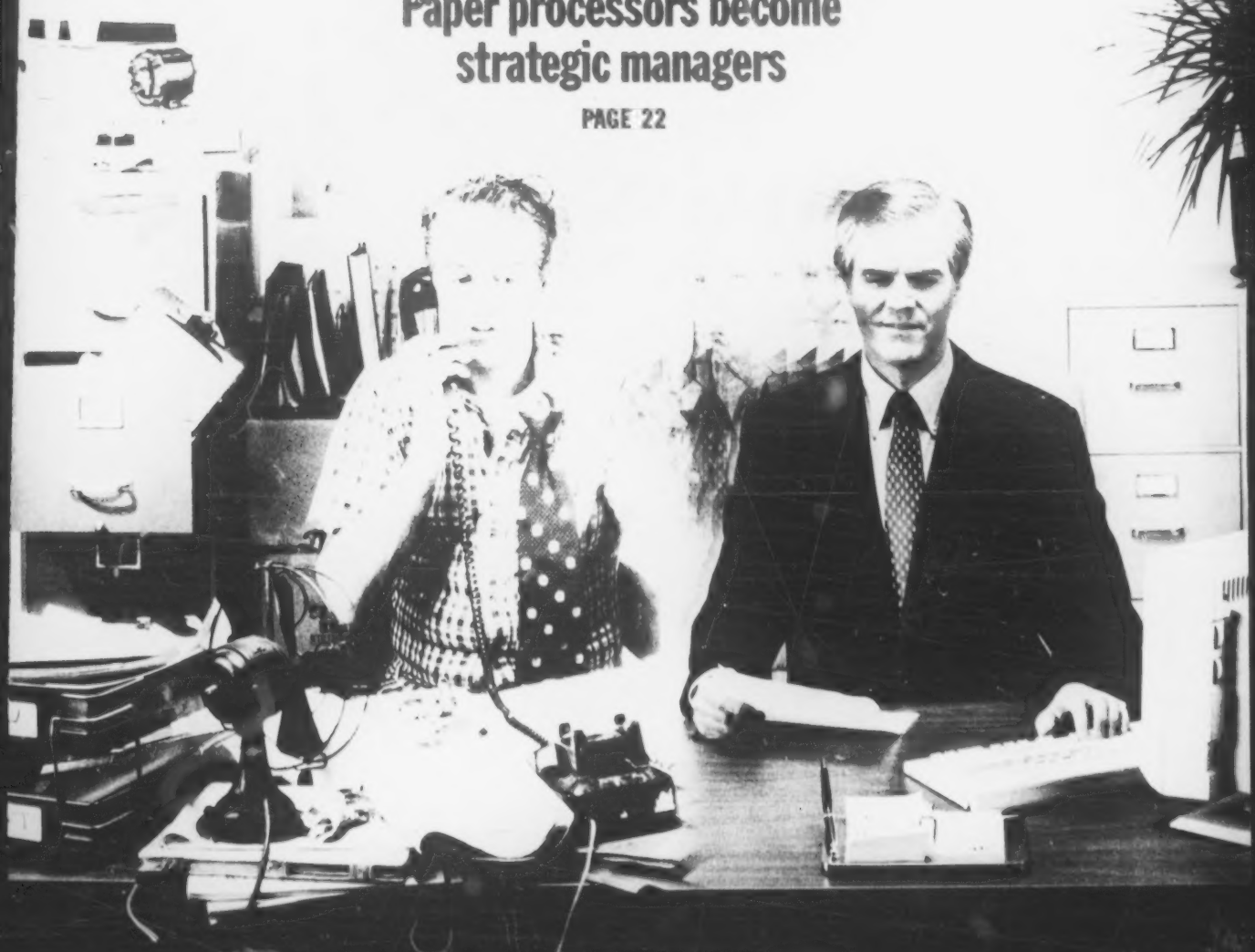

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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES — WORLDWIDE

VOL. 17, NO. 6 MARCH 20, 1989

PAGE 22 The changing face of purchasing: Paper pushers become strategic managers

COVER STORY/MANAGING RESOURCES

22 The changing face of purchasing

Earlier this year, Apple Computer admitted to a serious miscalculation. After hoarding expensive DRAMs when the market was tight, chip supplies loosened, prices fell and the personal computer maker was stuck with a stockpile of overpriced memories — a costly purchasing blunder. Apple's dilemma is not unique. A single purchasing decision can save or lose millions of dollars for a company. As a result, purchasing, long relegated to an inferior status within the corporation, is coming out of the closet.

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In a business climate where a single misguided decision can save or lose millions of dollars for a company, a new spotlight has been placed on procurement. Paper pushers are becoming strategic managers.

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HP has a top-down effort to do a better job of purchasing — from the issuance of a quality improvement challenge to a rigorous analysis of procurement practices.

27 Why purchasing is becoming the new frontier
If purchasing is evolving from paper processing to a strategic management function, there is no shortage of reasons for the change.

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OEMs are starting to quantify the cost of buying cheap components, and it is changing their purchasing habits.

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The era of basic research is over for Siemens as each one of its 16 new divisions has its own market-oriented R&D activities. The aim is to ensure closer contact between the research and the market it serves.

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Cover photograph: Renee Fraser. Retouch: Photo Coloratura Ltd.

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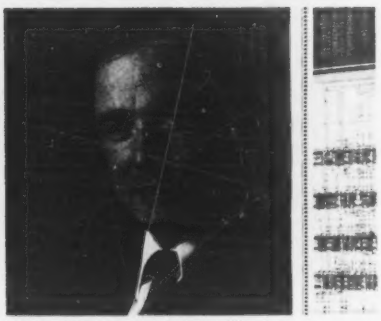

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78 The electronics cookie jar is loaded with M&A goodies

Virtually no sector in the industry — whether hardware, software or computer services — has escaped the trend of merger and acquisition. Intensifying competition is guiding the trend.

86 Are electronics firms the last to embrace EDI?

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Here's the inside scoop on how Japan's top electronics and computer companies nickled and dimed their yen problems away.

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A year ago the promise was great for mixed-analog digital ASICs, and that promise still holds today. But there's a but: Anticipated software and test equipment have been slow to evolve.

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Purchasing: The new frontier

Purchasing has never been a glamorous profession. How many CEOs have risen from the ranks of purchasing, for example? And how often does the *Wall Street Journal* profile purchasing geniuses? Fact is, compared with marketing and finance, purchasing gets no respect. "If you get a hernia, you wind up in purchasing," goes a joke bandied about the halls of corporate America.

But a variety of factors have combined to put the spotlight on procurement. For example, between 40% and 95% of the cost of goods sold is attributed to purchased material. Thus, mistakes can be costly; indeed, purchasing errors can be disastrous. Meanwhile, global competition demands shorter product life cycle times and international sourcing. The list goes on.

Most electronics companies have been late in realizing the implications. But now, the face of purchasing is changing. Harried paper pushers are becoming sophisticated procurement strategists. Firms that once relegated purchasing to the bottom rungs of the corporate ladder are heaping status on the underrated profession. Purchasing managers are being promoted to corporate vice presidents for materials management. And corporate vice presidents for materials management are being promoted to more important positions.

Moreover, increased pressures are forcing suppliers and customers to become long-term partners. Buyers say that they are less likely to haggle over pennies and more likely to consider a variety of factors — including quality, on-time delivery, cost and responsiveness. Many firms are slashing their supplier rosters. Some favor single-sourcing many components. All these factors are combining to make sophisticated procurement policy a No. 1 concern.

Beth Karlin

Of course, not all firms are savvy enough to realize the danger of clinging to old-fashioned purchasing practices. For those that have — and perhaps more importantly for those that haven't — embraced the new religion of sophisticated purchasing, especially, we present our cover stories on the changing face of purchasing written by contributor Sylvia Tiersten and senior editor Bruce Rayner. And this is just the beginning. ELECTRONIC BUSINESS editors will follow important purchasing trends in issues to come. Next: the sometimes hostile and always changing relationship between automakers and their electronic component suppliers.

BETH KARLIN

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BPA ABP

Visual sees the light from X-Windows technology

This struggling terminals vendor is staking its future on an embryonic market — but the big boys are coming

Visual Technologies Inc. may see the light at the end of its financial tunnel — and that light is streaming in through the X-Windows market.

The vendor of text and high-end graphics terminals has been struggling in recent years since the terminals business became a rough-and-tumble commodity market. Now the Lowell, Mass., company is staking its future on a line of terminals products incorporating X-Windows technology.

Visual's dilemma and its strategy for returning to profitability are indicative of two trends in the computer industry: efforts by terminals vendors to add value to their wares and somehow distinguish themselves in the marketplace; and the growing number of vendors that are incorporating X-Windows technology into their products.

"They're all trying to get better margins, somehow," says Prudential-Bache Securities Inc. analyst Kimball Brown, speaking of terminals vendors. Between 1985 and 1992, the compound annual growth rate in units is projected at an anemic 7.2% for alphanumeric terminals and 8.8% for graphics terminals, according to Eileen O'Brien, an International Data Corp. senior analyst who follows the terminals market.

Many companies have been adding intelligence to their terminals and marketing them as diskless personal computers, while others — such as Wyse Technology — have added PCs to their product line. Visual itself made a disastrous effort to enter the personal computer arena in the mid-1980s.

"Market share and price competitiveness had become more of an issue than innovation" in the terminals business, says Visual OEM sales and marketing vice president Larry Lunetta. "The company has had some difficult times in previous years."

After Visual racked up losses of $13.5 million on sales of $21.6 million in 1986, an investment group led by Hambrecht & Quist Venture Partners assumed majority ownership and control of the company in April 1987. In the months that followed, the company's debts were restructured and its management reorganized with a number of executives departing. In 1987, Visual's sales dropped to $15 million and the company reported a loss of $7.2 million.

In early 1987, Visual identified the embryonic X-Windows market as a promising niche in which the company could leverage its technical and marketing expertise. "X-Windows was emerging as early as 1987 and was one of the few standards that was not being argued over," Lunetta says.

Developed at the Massachusetts Institute of Technology, X-Windows has been endorsed as a standard by nearly every major computer vendor. A windowing system allows a computer screen to simultaneously display multiple applications, and X-Windows extends that capability to a multivendor network. The system's graphics and communications protocols provide software developers with a standards-based foundation upon which they can build applications.

Visual unveiled the 640 X Display Station last August and touts the product as offering the ease of use of a terminal combined with the functionality of a workstation. Built into the product is the server or display portion of X-Windows Version 11, which allows the terminal to access over a network the client or host portion of X-Windows implemented on a computer. The 640 XDS, which is based on Visual's older Series 600 terminal and uses the Motorola 68000 chip, offers a monochrome bit-mapped 1,024-pixel by 800-pixel resolution display and Ethernet networking capability.

Visual worked with XPI Inc., a Providence, Rhode Island-based developer of X-Windows software and networking technology, to design the 640 XDS terminal. However, outside of MIT and Digital Equipment Corp., XPI was the first company to incorporate the X-Windows system into its networking and software

John Kennard

Visual Technologies' OEM sales and marketing vice president Larry Lunetta: Moving into the X-Windows market, the firm's attitude now is that of a start-up

products. Last November, Visual acquired the privately held XPI for an undisclosed sum and named XPI president Brian Chapin to the post of advanced marketing and technology vice president.

Visual has been shipping the 640 XDS in volume since September, and by January had over 500 units installed with order backlogs of 30 to 60 days, according to Lunetta. The terminal, priced at $1,995, is manufactured for Visual by Oriental Precision Co. Ltd. in Korea.

Visual is selling the product through computer manufacturers, OEMs, large-volume VARs and what Lunetta describes as "sophisticated end users" who integrate their own systems. Target markets for the 640 XDS include text and graphics applications in desktop publishing, financial systems, software engineering and factory automation. CAD/CAM will also become a target market later this year when Visual unveils a color version of the product.

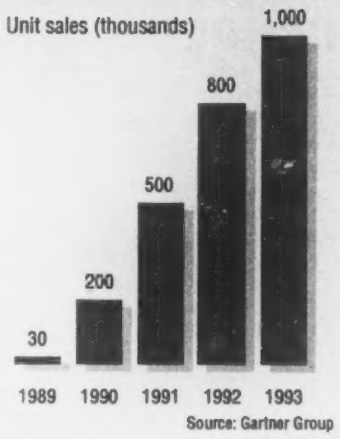
Allies in the X-Windows world

Last December, Visual inked a multiyear OEM distribution deal with Kubota Computer Inc. of Japan valued at $2 million in the first year. Vendors that have developed interfaces to Visual's terminal-based server include Applix Inc., Westborough, Mass.; Cimlinc Inc., Elk Grove, Ill.; Frame Technology Corp., San Jose; Oracle Corp. of Belmont, Calif.; and Sequent Computer Systems Inc. of Beaverton, Ore. Visual has also signed an agreement with Sorbus Inc. to service the 640 XDS.

Visual plans to broaden its product line using the XPI technology. Although the company continues to sell standard terminals, they are expected to account for only 50% of Visual's sales this year and an increasingly smaller percentage of its business in the future, according to Lunetta. "I think it's fair to say that Visual is moving out of the terminals business and moving into the X-Windows market," he says.

In fiscal 1988, ended September 30, Visual reported a loss of $6.2 million on sales of $8.5 million. Meanwhile, the company is striving for sales of $18 million this fiscal year and is hopeful of breaking even or turning a small profit. "We have an organizational attitude that is as much a start-up as anything else," Lunetta says of the atmosphere at Visual.

X-Windows display stations



While IDC's O'Brien foresees potential within the X-Windows market, she believes it will be three to five years before it really catches on. "People are not going to just dump their [standard] terminals overnight," she says. "The X-Windows market is really in its infancy." Dataquest Inc. senior industry analyst Robert Cameron also believes that demand for terminals incorporating X-Windows technology is several years away. "I believe we're talking 1995," he says.

The entrance by large vendors could add legitimacy to the market and fuel its growth

The Gartner Group research firm in Stamford, Conn., is projecting that worldwide unit volume sales of X-Windows display stations (terminals, diskless personal computers and workstations) will reach 30,000 units this year and increase to 200,000 units in 1990; 500,000 units in 1991; 800,000 units in 1992; and 1 million units in 1993. Gartner Group vice president Craig Symons states that the average price of a display station will be $2,500 this year and will drop by approximately 30% to 40% each year.

"The real issue is whether users will adopt this technology," Symons says. He believes that may happen as part of a backlash against the increasing complexity of personal computers and their attendant software and networking technology. X-Windows display stations, he says, will offer the same functionality as a PC or workstation while leaving the complex backup, troubleshooting and other chores to a central computer system.

But will they sell?

"I think that Visual, in general, is one step ahead of the crowd," says IDC's O'Brien. Other terminal vendors now entering the X-Windows market include Acer Counterpoint Inc. of San Jose, which markets the Xebra Model 100 terminal for low-end X-Windows applications; and Tektronix Inc. of Beaverton, Ore., which recently unveiled the 4211 Graphics Netstation; and Network Computing Devices Inc. of Mountain View, Calif.

But a potential curse — or blessing — for vendors like Visual is the expected debut of competing products from big vendors. Digital in particular is heavily promoting its DECwindows technology based on the X-Windows system. The entrance by large vendors could add legitimacy to the market and fuel its growth, analysts say, but smaller vendors could find themselves crushed by the bigger companies.

DEC is adding DECwindows functionality to its operating systems and to all its workstation and personal computer systems. However, Cameron says he believes that DEC will debut a DECwindows server terminal inside of 18 months. Currently, DEC is pushing its independent software vendor allies to adapt their products to DECwindows specifications.

Prudential-Bache's Brown believes that Visual will face severe competition from DEC and other major vendors when they begin marketing terminals with X-Windows technology. He says Visual may be able to compete on a technology basis by offering a better product, but that lower prices alone will not be enough to compete with the big vendors.

RICK WHITING

AT&T-Italtel combo may aid private telecom growth

In addition to raising Italy's private telecom vendors' hopes, AT&T is boosting its own position in Europe, anticipating 1992

Will the alliance of AT&T with Italy's state-owned telephone equipment maker Italtel SpA give the Italian private telecommunications market the shake-up it needs?

Italy is the third country in which AT&T has initiated a joint venture with the "national champion." Combined with similar ventures in Holland and Spain, the new Italian deal should offer AT&T an excellent market position when the next generation of telecommunications products is developed. When customs borders cease to exist in post-1992 Europe, AT&T should already be poised to offer pan-European products.

AT&T will work with Italtel in fulfilling a $30 billion plan to improve the Italian public network. AT&T is eager to get a share of this investment, and should become a close collaborator with the Italian public telecom system.

Operators are hoping that AT&T's work with the public provider will give the private telecom market a much-needed boost. The backward state of Italy's public telecom network, combined with overregulation, is suffocating the Italian market for private telecom products.

"It's a strange, typically Italian paradox," says Franco Morganti, a telecommunications analyst at the Milan-based Technibank SpA. "In some areas of our country, information technology is in a very advanced state. But the laws governing telecommunications are backward and the public telecommunications network with reasonable tariffs doesn't exist. It's the same with all of our monopolized public services."

"AT&T is a manufacturer and a carrier," he adds. "We hope its vast experience will be used to help our troubled public system."

Analysts hesitate to estimate the potential market for private telecom, given the huge disparity in size and sophistication among the different kinds of equipment that are in use. However, the London-based consulting firm Dataquest UK Ltd. estimates that the current Italian market for end-user products is about $1.12 billion. But analysts say the potential is much greater.

"The market is impoverished," says Giovanni Lizzieri, of another Milan consulting firm, Reseau SRL. "The qualitative and quantitative structural flaws in the public [networks] have strangled the Italian market in private networks and in value-added services. This means that vendors of telecommunications technology have a sickly, starved market, even though the market for these products is healthy enough in most other countries."

Franco Boscu, director of private telecom for Siemens Italia SpA, agrees. "Sometimes our projects get held up because we become involved in long negotiations with the SIP [the Italian phone company] about who handles which interface between the private network and the public," he says. Despite the respectable number of Italian computers, he says, "we construct only four or five major private networks a year."

The Italian private-network builder has only three ways to connect the various parts of his network. He can use the public telephone service, but this means exposing his operation to the risks inherent in a principally electromechanical network that already has more traffic than it can handle. Or he can use the "Fonia-Dati" network for data transmission which has very high quality — but also high cost. Or he can use the Italian public X.25 packet switching network "ITAPAC," which is run by the SIP and the Ministry for the Post, which has relatively few modes of access and is also rather expensive. "The result is that we don't sell many new private networks, we only improve the [approximately 2,000] ones that already exist," explains IBM telecom director Renzo Botazzi.

Another factor that brings up the cost of constructing a private network in Italy is the incoherent tariff policy used for the obligatory rental of lines. "There are too many different laws that govern tariffs, and the resulting tangle makes the business unnecessarily complex," complains Bull HN Italia SpA marketing director Giacomo Zanone. "Because of the special measures adopted to develop the south of Italy, it costs less to rent a line from Milan to Palermo than from Milan to Florence." Palermo is more than twice as far from Milan as Florence.

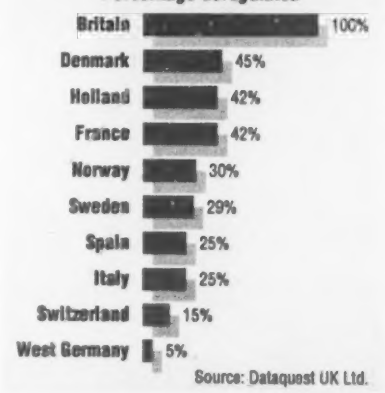
Since the network market in Italy is so small, the services available for such networks are also very limited. "The Italian market for value-added networking services is also overregulated," continues Reseau analyst Lizzieri. "General Electric Information Services Italia SpA controls the lion's share of the market, about 41%, and most of their clients are the few, large corporations that we have."

A proposed law under consideration by the Italian parliament would make selling and operating private networks a lot easier. But operators are skeptical about the law's ever making its way through the Byzantine network of Italian politics.

All the companies that operate in the area of private telecom are looking forward to the deregulation that is expected in 1992. Says Ing. C. Olivetti & Co. SpA information systems specialist Giacomo Repetto, "Once it becomes easier for computers to communicate, there will be a lot more communicating."

ANDY ROSENBAUM

Current levels of telecom deregulation in Europe



Source: Dataquest UK Ltd.

The electronics cookie jar is loaded with M&A goodies

Virtually no sector in the industry — whether hardware, software or computer services — has escaped the trend of merger and acquisition

BY RAY WISE

Merger and acquisition activity has hit a new high in electronics, powered by intensifying competition in the industry, technological change and a snobbish market for initial public offerings.

There were a record 594 mergers and acquisitions of hardware, software and computer services companies in 1988, 19% more than the 499 recorded a year earlier, and hardware companies alone accounted for 160 deals, compared with 141 in 1987, according to George Grodahl, partner in the San Francisco office of Broadview Associates. The investment banking firm headquartered in Fort Lee, N.J., specializes in M&A in the information technology field and tracks these deals closely.

"There is an extremely high level of M&A activity in technology these days," says George Von Gehr, partner in Vol & Covington and M&A boss for the San Francisco-based investment banking house. Hambrecht & Quist, in the same city, concurs. "The volume of activity is up strongly," reports Jim Timmins, a partner in H&Q's investment banking division.

The new M&A department of Advent International, venture capital firm in Boston, already is busily engaged in deal making. "We currently are working on five deals, and we haven't started marketing. We don't even have a brochure to tell people what we do. Once we begin advertising, we'll have more work than we can handle," says Steve Kahn, director, mergers and acquisitions.

Many of the M&A deals being cut these days are valued under $25 million. "The buyers are either large, public companies or 'privates' in the $50 million to $200 million annual sales range acquiring smaller brethren that are struggling in one way or another," says Timmins. "I can think of no sector in electronics that has escaped the M&A uptrend. Hardware, software, defense electronics, telecommunications. You name it."

Foreign buyers abound

Encouraged by the appreciation of their currencies against the dollar, foreign buyers abound, picking and choosing from the wide array of technologies available in the U.S. and paying discount prices. "It's like dipping into a cookie jar," says Von Gehr. "If you're a German or Japanese or Taiwanese company, it's hard to put together an infrastructure in the U.S. Some surprisingly large overseas outfits do not have substantial infrastructures in this country."

1988's top 5 deals in electronics and computers

Top M&As in terms of dollars from one or both sides of the hardware, software or computer services industry. Covers companies acquired in the U.S. only

1. Nippon Mining Co. acquires Gould for $1.1 billion.
   Status: Completed; **Type:** Friendly
2. MAI Basic Four offers $970 million for Prime Computer.
   Status: Pending; **Type:** Hostile
3. Memorex International acquires Telex for $922 million.
   Status: Completed; **Type:** Friendly
4. Prime Computer acquires Computervision for $457 million.
   Status: Completed; **Type:** Hostile
5. Unisys offers $332 million for Convergent Technologies.
   Status: Pending; **Type:** Friendly

Source: Hambrecht & Quist Inc.

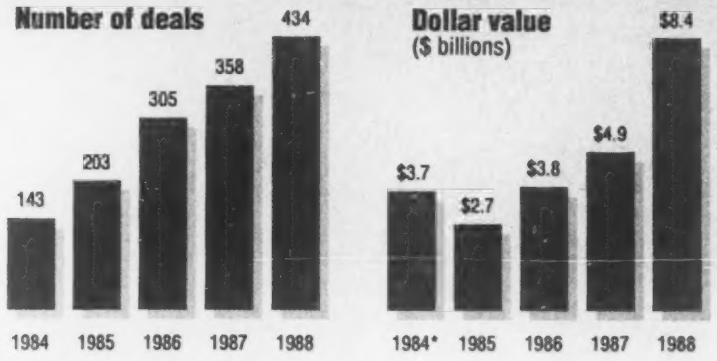
The high volume of M&A deals also reflects conditions in the U.S. electronics industry. Nourished by a greatly expanded venture capital industry, hordes of companies have streamed into electronics in recent years, making consolidation inevitable. "There is a lot of consolidation going on, a lot of heavy competitive crowding in the computer industry, and a lot of acquisitions for survival," notes Dorothy Langer, vice president of 3i Ventures, Boston.

"There is going to be a lot more consolidation, especially in software," Langer predicts, stressing that most relatively new, highly profitable businesses attract an army of new entrants that must be shaken out eventually. Moreover, some sectors of electronics have experienced disappointing growth rates recently, further fueling the trend toward protective mergers and acquisitions. Acquirers simply are buying out the competition, or bolstering themselves through diversification or by absorbing smaller ventures that offer strategic "fits" with their own product lines.

The strategic acquisitions usually result from "buy rather than make" decisions. "Companies are finding that developing new products is expensive, time-consuming and risky, and that it is cheaper, faster and safer to buy a proven capability," says Grodahl. The larger outfits seem to be less effective at doing R&D; entrepreneurs, on the other hand, have a way of rolling their sleeves up and getting it done. For these and other reasons, Grodahl adds, "there are more acquirers out there today than ever before."

Apple Computer Inc. has been an acquirer from time to time, as a means to an end, says Jane A. Risser, manager of investor relations. "The end is to continue to innovate, in

M&A activity in software and computer services



* 1984 figure includes General Motors' acquisition of EDS (Electronic Data Systems) for $2.5 billion

Source: Broadview Associates

hardware and software, to increase the productivity of the desktop computer. In the past, the acquired companies have been in software."

Industry standards

Industry standards are another catalyst for M&A activity, according to Langer. "The hardware manufacturers are going to Unix, and they all need third-party, applications software. They can't write it themselves."

Philip Barton, who runs the Fidelity Select Software and Computer Services Portfolio, Boston, points out that while small companies can be excellent vehicles for technological innovation, they often need partners. Moreover, he says, partnering is being nurtured these days by technological progress and product upgrading. The PC-workstation cycle is kicking into high gear, fostering advances in chip technology, processor logic and operating system software and, in the process, has created a window for entrepreneurs. Some of them, fearing they will miss out on the technological wave if they delay participation long enough to grow on their own, are scrambling for partners instead, Barton reports.

Moreover, the new chip technologies are proving a headache to those innovative IC designers who use the fabrication lines of others — the so-called "fabless wonders" — that find it is becoming increasingly necessary to have a line of one's own. To build one requires a partner having pockets that are about $100 million deep.

As the acquirers must face an increasingly competitive marketplace, so must their smaller counterparts. Being acquired can inject cash into an enterprise, furnish distribution channels for its products and increase critical mass enough to make the merged company stand out in the crowd and display viability to its customers and prospects. "Entrepreneurs inevitably are asked, "will you be around to take care of me if I buy your product? Can you support me on a global scale?" " says Grodahl. Some entrepreneurs fear the U.S. will undergo a recession in a year or so, and Von Gehr notes that a "recession heightens the need for cash and for distribution channels." A recession by 1990, accompanied by rising interest rates and debt service costs and a profit-suppressing tax increase is the forecast of Richard M. Rodnick, chairman of Geneva Co., financial services firm based in Irvine, Calif. Rodnick figures that an economic slowdown would end the M&A boom and so, he says, entrepreneurs wanting to sell out should consider doing so over the next few months while prices are still favorable.

The high volume of M&A deals reflects conditions in the electronics industry

Meanwhile, the IPO market has become so severely selective that most small electronics companies no longer can count on it as a source of capital. "The IPO route is a real gamble. People don't want to put up the money to allow these companies to grow independently," says Christian F. Horn, president of Grace Ventures, Cupertino, Calif. Barton points out that only well-established companies having solid track records in revenue and earnings and rated highly by their customers have a prayer of going public. The market still is replete with undervalued high-tech shares, especially in the data storage, chip and chip-making equipment sectors. "A lot of the market's behavior is emotional," according to Timmins. "Most of the companies are doing well, but they can report earnings and revenue gains of 50% to 100% and get absolutely no reaction from the market. The shares don't move."

Given the condition of the IPO market, entrepreneurs often can make a better deal through M&A and, in addition, the acquirer usually must pay a "control premium" for taking over the enterprise, notes Katherine R. Kirk, a partner in the Boston office of Hambrecht & Quist.

Selling a company can be like selling a dream, but Barton points out that some deals are structured to allow the entrepreneur to keep his or her hand in the venture for a time and profit by its success. The purchase price in an "earn out" consists of a straight distribution of cash and stock in the acquiring company, plus a deferred incentive bonus that is paid if the acquired operation meets certain financial objectives. "About 25% to 30% of M&A transactions are earn-outs," according to Grodahl.

Historically, venture capitalists have kept their portfolio companies going in bad IPO markets, but they aren't so quick to reach for their checkbooks these days. Horn says some are grappling with problem companies that already are in their portfolios. Others are passing up new ventures in favor of going into the stock market and buying up undervalued technology shares, Timmins reports.

"Companies are finding that they don't have financing alternatives to M&A," according to the investment banker. □

How Japan overcame the high-valued yen

Here's the inside scoop on how Japan's top electronics and computer companies nickled and dimed their yen problems away

BY PAULA DOE

What would you do if the dollar suddenly appreciated by more than 70%, making your products that much more expensive in overseas markets? For export-oriented Japan Inc., which saw the yen appreciate by 77% over a three-year period, the question was not hypothetical. Indeed, because of the highly appreciated currency, the average pretax earnings per employee for Japan's 29 largest publicly held electronics companies plummeted from $26,700 in 1985 to less than $12,000 just two years later.

However, Japan has spent little time wallowing in self pity. On the contrary, the major electronics companies there have been busy holding overseas prices in check by whittling down costs at every corner. In typical Japanese fashion, drastic measures such as massive layoffs were avoided in favor of yen-pinching approaches involving the finetuning of existing operations. The subtler strategy appears to have paid off. The operating income of Japan's top 29 electronics companies surged 73.9% to $5.8 billion in fiscal 1988, ended last March.

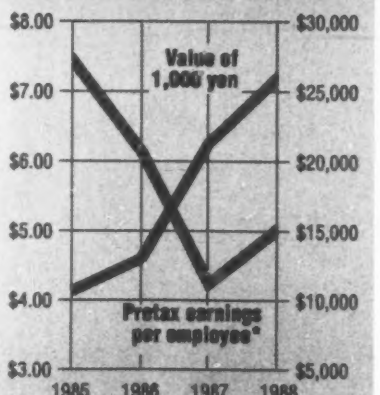
ELECTRONIC BUSINESS tracks the leading Japanese electronics companies using detailed financial reports *(Yuka Shoken Hokoku)* published by Japan's Ministry of Finance and the exhaustive compilation of industry statistics *(Shuyo Kigyo Keiei Bunseki)* put out by the Bank of Japan. Figures from the company reports are also available in the annual *Kaisha Nenkan*, published by *Nihon Keizai Shimbun*.

All these Japanese-language sources offer much more detail than the annual reports available in English, specifying everything from how much a company spent on advertising to how much it spent on capital equipment at each of its plants.

Exactly how did the Japanese manage to ground the high-flying yen? At Fujitsu Ltd., personnel costs were cut 13% and manufacturing overhead reduced by 5% in fiscal 1988, a year in which sales grew by 16%. Revenue at Hitachi Ltd. remained flat, but the company spent 3% less on materials. Indeed, much of last year's big recovery at Japan's major electronics companies came from squeezing out additional small-scale improvements in already lean manufacturing operations.

Trimming manufacturing costs by a few percentage points was enough to get operating margins at Japan's major electronics companies back up to 3% to 4% of revenue for fiscal 1988, a marked improvement from 1% to 2% the year before. That may not sound like anything to write home about, but even in the heady days of 1984, operating margins for the Japanese sector as a whole were only 6.7%.

The Japanese begin to recover from the rapid appreciation of the yen



Figures are for the fiscal year ending in March.
* For Japan's 29 largest publicly held electronics companies. Figures are converted at a constant ¥125 = $1, for convenience purposes only.

Sources: Bank of Japan, Federal Reserve Bank of New York

Forget the massive layoffs

Even in the face of the high yen, the major Japanese companies have not resorted to draconian measures like massive layoffs or major corporate restructurings. Despite the flight of production offshore, the parent Japanese companies have not appreciably cut back on domestic employment. The total number of permanent employees for all 29 parent companies in the sector tracked by the Bank of Japan actually went up about 2% last fiscal year, while each of the five largest companies cut staff by a mere 0.5% to 2%.

Nor did the big Japanese electronics makers cut back on their selling, general and administrative expenses. These costs went up 10% for the sector, increasing a consistent 10% to 14% at all the big companies, which equaled or surpassed revenue growth in all cases. Companies also kept up their research and marketing spending. Not surprisingly, they could do little to trim such costs as utilities, taxes and depreciation. Many of the companies did, however, trim their administrative staff costs, presumably, in part, by cutting bonuses. SG&A personnel costs for the sector as a whole were down 3%, to a mere 3% of total sales. In particular, Fujitsu cut its support personnel costs by a whopping 35%.

What the Japanese companies did was to squeeze a few more percentage points out of their already lean product costs, and each company found a different place for improvements. For the sector as a whole, the biggest

improvements came in product costs other than manufacturing, which essentially means outside purchases. While sales climbed 6% for the sector as a whole and manufacturing costs increased 5%, product costs other than manufacturing climbed only 3.5%.

At Matsushita Electric Industrial Co. Ltd., sales were up 3% and manufacturing costs up 8%. But nonmanufacturing product costs increased only 2% — which accounted for most of the company's improved operating margins. In other words, Matsushita paid proportionally less for the products it purchased outside. This achievement was thanks to Matsushita's numerous suppliers, including the company's own subsidiaries and affiliates, which scrambled to set up low-cost production facilities abroad. By moving offshore, the Japanese transformed their high-valued yen, with its mighty international purchasing power, from a crippling handicap to a significant advantage.

Don't cry for me Tokyo

The brawny yen also helped the Japanese keep materials costs down, as many companies began to buy more parts from offshore sources. Indeed, materials costs were the next biggest area of savings, going up only 4% to support a 6% increase in sales for the Japanese electronics sector as a whole. Hitachi made its biggest cuts in materials costs, trimming them by 3% while maintaining virtually the same volume of sales as the year before. Toshiba Corp. similarly squeezed out a tiny cut in materials costs, while supporting a 7.2% increase in sales volume.

Raw material inventory turnover for Japan's electronics sector averaged 74 times for fiscal 1988, a 3% improvement from the year before. Total inventories, including purchased goods and finished goods, came to 74% of average monthly sales, while the companies turned over their total inventories an average 10 times, 4% better than the year before.

For the Japanese electronics industry, manufacturing overhead expenses outpaced growth in sales volume. Fujitsu, however, cut its costs primarily by trimming its manufacturing overhead, achieving nearly 5% savings even though sales volume was up approximately 16%.

Manufacturing labor costs increased slightly at most companies, but not as sharply as sales. NEC Corp., in fact, improved its operating margins by holding manufacturing labor costs at fiscal 1986 levels, while achieving an 8% increase in sales volume.

The major Japanese companies also managed to squeeze out modest increases in worker output. Sales per employee for the electronics sector as a whole were up 4%, with rates at the major companies ranging from 4% to 15%. Value added from operations per employee increased 7% for the sector and 2% to 12% at the major companies.

Obviously, because of the high-valued yen, the Japanese can't boast cheap labor costs anymore. The leading electronics companies are paying an average salary, including benefits, of $44,700 a worker, up 18% in dollar terms over the last year. With personnel costs still averaging 13% of sales, that hurts.

Nor are the Japanese companies significantly more globally oriented than the U.S. sector anymore. Exports for the Japanese sector as a whole averaged 30%, while Fujitsu, Hitachi and NEC got less than 30% of their total consolidated worldwide sales abroad. Overseas sales for the ELECTRONIC BUSINESS 200 averaged 25% of total revenue in 1987. And many major U.S. companies, including IBM, Digital Equipment Corp., Unisys Corp., Xerox Corp., Hewlett-Packard Co. and Motorola Inc., to name just a few, had foreign sales reaching 40% to 50% of total revenue.

Shattering a myth

Debt levels at the Japanese companies are not as high as myth would

Ray Medici

have it. Debt runs 33% of total capital for the sector overall, compared with 28% for the ELECTRONIC BUSINESS 200. Some of the more highly leveraged companies, such as NEC, carry debt that reaches 66% of its total capital, well above the U.S. average, but certainly not out of the range of some big U.S. electronics makers. Lockheed Corp., Singer Co., Emerson Radio Corp., Contel, and United Telecommunications Inc. all similarly have debt comprising over 60% of their total capital. In fact, debt levels at 30% to 50% of total capital are common in the United States.

One area in which the Japanese did little scrimping was in R&D. For the major electronics companies in Japan, R&D expenses totaled 6% to 16% of revenue last fiscal year, up 4% to 16% from the year before. The average for the Japanese electronics sector as a whole was something less than 7% of sales, although the Bank of Japan does not collect exact figures. For the top 20 U.S. electronics companies, R&D spending averaged 7.5% of sales during roughly the same time period. □

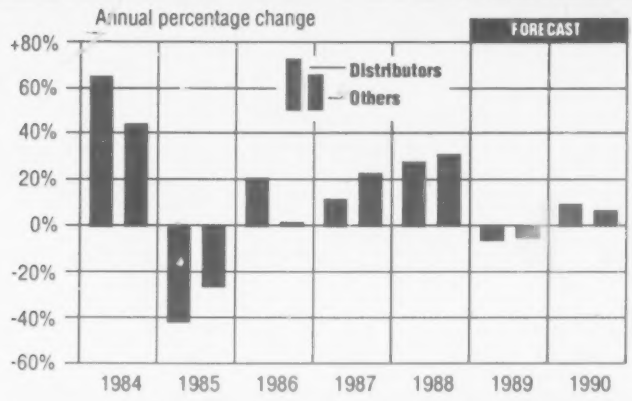
How the Japanese recovered from the high-valued yen

	Japanese electronics sector	Change	Fujitsu	Change	Hitachi	Change	Matsushita	Change*	NEC	Change	Toshiba	Change
Fiscal 1988 sales ($ billions)	$174.7	+6.2%	$13.7	+15.7%	$23.4	-0.2%	$26.2	+3.4%	$18.4	+8.5%	$21.5	+7.2%
Relative costs (as percentage of total sales)												
Cost of sales	**76.7%**	**+3.5%**	**83.6%**	**+12.9%**	**76.8%**	**-4.4%**	**80.9%**	**+1.9%**	**69.2%**	**+6.8%**	**75.2%**	**+2.7%**
Cost of manufacturing	58.3%	+4.9%	56.0%	+10.6%	76.7%	-1.4%	24.9%	+8.7%	55.8%	+7.2%	53.9%	-1.8%
Materials	39.4%	+4.3%	44.1%	+11.5%	41.9%	-3.0%	19.1%	+11.6%	46.6%	+6.3%	35.7%	-0.2%
Labor	9.6%	+5.2%	7.9%	+5.8%	14.0%	+1.3%	3.9%	+4.0%	7.4%	+0.3%	10.9%	+3.7%
Overhead	11.9%	+9.5%	5.5%	-4.6%	20.6%	-1.4%	2.9%	+3.9%	17.8%	+14.0%	7.9%	-0.4%
Account transfers	-2.6%	—	-1.5%	—	-0.2%	—	-1.0%	—	-16.0%	—	-0.6%	—
Selling, general, and administrative costs	**20.0%**	**+10.1%**	**32.4%**	**+14.2%**	**18.9%**	**+11.4%**	**16.7%**	**+11.5%**	**27.0%**	**+10.4%**	**21.6%**	**+12.2%**
Personnel	3.3%	-2.9%	4.0%	-35.4%	2.3%	+3.9%	3.9%	+0.0%	2.8%	+14.2%	3.3%	+9.3%
Operating income	**3.3%**	**+73.9%**	**4.0%**	**+131.9%**	**4.3%**	**+49.2%**	**2.3%**	**+3.2%**	**3.8%**	**+38.6%**	**3.0%**	**+119.6%**
Estimated value from operations (as percentage of total sales)												
Value added from operations	**21.0%**	**+9.1%**	**22.6%**	**+2.7%**	**25.8%**	**+6.4%**	**12.6%**	**NA**	**19.8%**	**+10.7%**	**22.6%**	**+9.4%**
Expenses other than outside purchases:												
Personnel expense	12.9%	-3.0%	11.8%	-12.9%	16.3%	+1.6%	7.8%	NA	10.2%	+3.7%	14.2%	+4.9%
Rents & leases	0.1%	-48.3%	0.4%	-9.0%	0.3%	+3.8%		NA	1.4%	+10.9%	0.1%	-69.6%
Depreciation	4.2%	-0.6%	5.8%	-5.0%	4.1%	-10.5%	1.5%	NA	3.8%	+9.5%	5.3%	-0.5%
Taxes charged as operating expense	0.5%	+34.3%	0.6%	+165.4%	0.8%	+79.8%	0.9%	NA	0.6%	+48.2%	0.0%	+0.0%
Use of labor (dollar figures in thousands)												
Number of employees	503,411	+1.9%	50,067	-0.5%	76,210	-2.3%	39,707	-0.9%	38,004	-0.9%	70,288	-0.6%
Personnel expense/ employee	$44.7	+17.9%**	$32.1	+1.3%**	$50.0	+21.7%**	$51.3	+19.9%**	$49.7	+22.4%**	$43.4	+23.3%**
Manufacturing labor expense/ SG&A personnel expense	2.91	+8.4%	1.37	+64.1%	6.18	-2.4%	1.02	NM	2.65	+12.4%	3.31	+5.0%
Sales/employee	$347.0	+4.3%	$271.0	+15.1%	$306.5	+7.9%	$660.3	+4.4%	$485.1	+9.5%	$305.3	+7.8%
Operating income/ employee	$11.2	+70.8%	$10.8	+30.9%	$13.3	+52.7%	$15.4	+4.2%	$18.3	+31.9%	$9.1	+121.0%
Value added/employee	$72.9	+7.1%	$61.2	+2.2%	$79.0	+8.9%	$83.0	NM	$96.3	+11.8%	$69.2	+10.0%
Value added/dollar pesonnel expense	1.63	+6.5%	1.91	+17.5%	1.58	+4.6%	1.62	NM	1.94	+6.6%	1.59	+3.9%
Use of capital (dollar figures in thousands)												
Investment/employee	$199.5	+11.0%	$190.6	+10.4%	$161.9	+8.8%	$385.1	+19.8%	$247.6	+2.3%	$134.4	+11.9%
Value added/dollar investment	0.40	+5.4%	0.32	-1.7%	0.49	+0.0%	0.22	+0.0%	0.39	+9.3%	0.52	-1.7%
Return on equity	5%	—	5%	—	7%	—	7%	—	4%	—	8%	—
Return on investment	4%	—	3%	—	4%	—	5%	—	2%	—	3%	—

All figures are for the fiscal year ending March 1988
Conversion rate: ¥125 = $1 NA = not available NM = not meaningful
*Changes for Matsushita are figured from the company's last full fiscal year, which ended November 1986
**Change in personnel expense per employee is figured in dollars

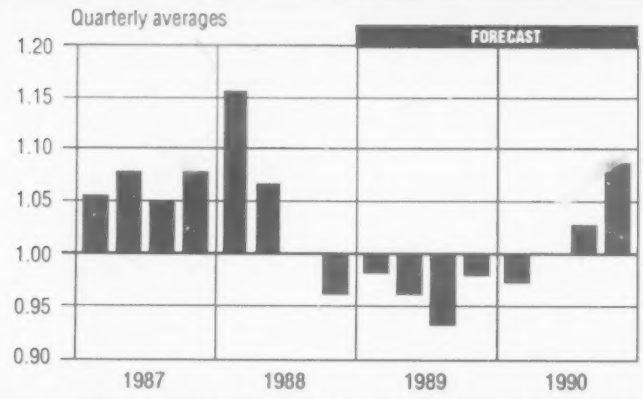
Percent change refers to the change in yen-based figures from March 1987 to March 1988, unless otherwise noted
Source: The composite figures for Japan's electronics sector are for the 29 largest publicly held electronics companies (unconsolidated), compiled in the Bank of Japan's annual analysis of Japanese industry. Individual company figures are for the parent company only, from company reports published by Japan's Ministry of Finance.

U.S. semiconductor sales growth



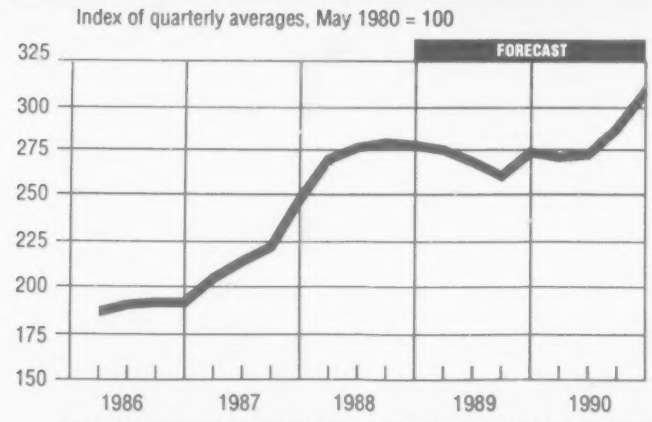
Historical data: Semiconductor Industry Association; Forecast: Cahners Economics

Distributors' book-to-bill ratio



Historical data: National Electronic Distributors Association; Forecast: Cahners Economics

Distributors' shipments index



Historical data: National Electronic Distributors Association; Forecast: Cahners Economics

Distributors dodging recession in 1989

When the economy slows down, everyone becomes afraid of the big bad wolf — recession. One group in the electronics industry has even more to fear from the recessionary wolf — distributors.

History has proven that when electronics sales fall, sales by distributors fall further. It makes sense, because when sales are booming and supplies become harder to obtain, more buyers turn to distributors in order to ensure reliable deliveries of the components they need. Meanwhile, that old maxim of business life still applies. What goes up must come down.

1984 and 1985 were classic examples of the extra volatility that distributor sales tend to experience. Distributors' semiconductor sales in North America surged 65% in 1984 and plummeted 41% in 1985 according to Semiconductor Industry Association surveys. During the same two-year boom-bust period, sales of semiconductors that did not pass through the distributor chain rose 45% and fell only 27%.

What's ahead for distributors?

Cahners Economics' forecast for total U.S. semiconductor sales calls for a 5% decline this year. Does that mean distributors of semiconductors should expect an even steeper drop? No, not this time. Last year, sales through distributors rose nearly 30% and other sales rose nearly 32%. Unlike past years, distributors' sales growth in 1988 nearly matched that of the rest of the industry.

And, unlike in 1984, supplies of most types of components were fairly easy to obtain. So the economic incentive to buy through distributors was not as strong in 1988 as it was in 1984. Indeed, distributors captured 25.3% of all semiconductor sales in 1984 and only 22.6% in 1988. While such a story was a disappointing one for distributors last year, the bonus this year is that sales through distributors will remain relatively stable.

Best of all, there's an excellent chance distributors and all other sellers of electronic products will escape a full-fledged recession altogether in 1989 and 1990. End-market demand will be weaker in 1989, compared with last year, but demand will not crumble completely. The most significant implication of this forecast is that distributors will face ever greater pressures to be more competitive both with price and service this year.

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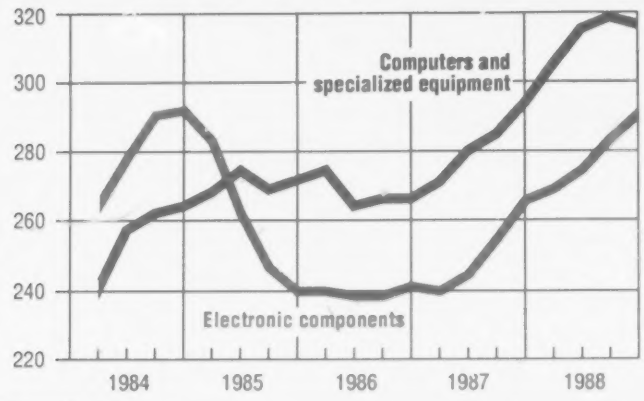
Components versus computer production

Index of quarterly averages, 1977 = 100, seasonally adjusted

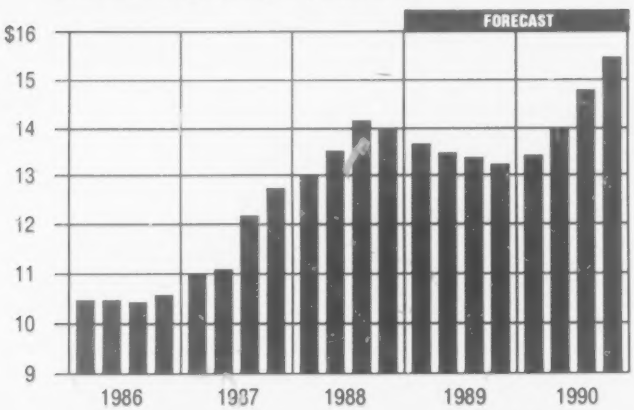


Components: SIC 367
Computers: SIC 357-9

Historical data: Federal Reserve Board; Forecast: Cahners Economics

Electronic components shipments

Quarterly averages, seasonally adjusted ($ billions)



Historical data: U.S. Commerce Department; Forecast: Cahners Economics

U.S. component imports/Apparent consumption

Percentage	1984	1985	1986	1987
Capacitors	22%	24%	30%	35%
Connectors	5%	4%	12%	10%
Integrated circuits	24%	28%	33%	36%
Printed circuit boards	8%	10%	13%	14%
Resistors	38%	24%	25%	33%

Apparent consumption is derived by subtracting the estimated producers' price of export from the sum of manufacturers' shipments and imports for consumption

Source: U.S. Bureau of the Census

Counting components in the United States

U.S. producers of electronic components did well in 1988 — so well they have nearly made up for the losses suffered during the last recession. According to the Federal Reserve Board's survey of domestic factories, output by November 1988 was only half a percentage point short of 1984's record breaking production levels.

Still, there's one problem with that half a percent shortfall. It's short. Why haven't U.S. component makers blasted past records? Take a look at the major component end markets. The computer and specialized equipment industry broke its 1985 record by 13.5%. Test and control instruments output raced ahead of 1986 records by 17.7%. Even U.S. production of motor vehicles and parts surged above 1985 factory records by 2%. Only communication equipment lost more ground than components, but then only 1.7% below 1985 records. The question remains, why haven't the production figures for components kept pace?

Statistical quicksand

One reason factory production of components fails in comparison with its end markets could be the increasing complexity of semiconductors. The Federal Reserve Board measures units produced of semiconductors, electron tubes, capacitors, printed circuit boards, resistors and other electronic components. They don't account for the fact that a function in a computer that used to require 10 devices now may require only one.

The statistics muddle the components industry performance for other reasons as well. The government gathers data from companies for which their primary product is components. A computer manufacturer that produces printed circuit boards as one step in the entire production of its final product, the computer, is not counted in the government's final tally of U.S. components. (Yes, that's the problem all analysts have measuring the captive markets.)

Despite this statistical quicksand, one fact stands firm. Imports of components continue to grow. According to the U.S. Census Bureau, imports accounted for 36% of U.S. apparent consumption of integrated circuits in 1987, up from 24% in 1984. Other component markets' import shares have risen as dramatically: capacitors up 35%, from 22%; printed circuit boards up 14%, from 8%; resistors up 38%, from 24% and connectors up 10%, from 5%. Where have all the components gone? Overseas.

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